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THREE NEW SPECIES OF *JATROPHA* (EUPHORBIACEAE) FROM WESTERN MEXICO

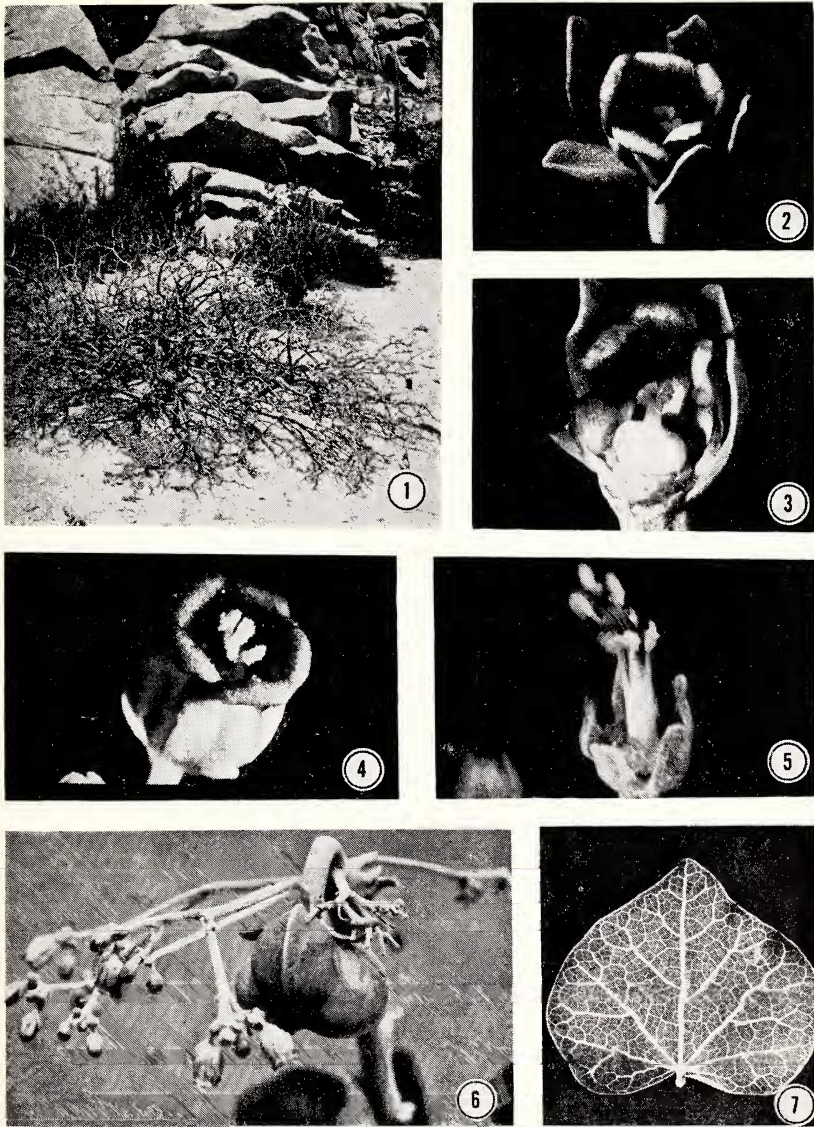
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In the course of field studies for an infrageneric revision of the genus *Jatropha* (Dehgan, 1976), three Mexican collections—two from Baja California and one from Jalisco—were found to differ from all species previously described from these areas (Mueller, 1866; Pax, 1910; Standley, 1923; McVaugh, 1945a, 1945b; Wilbur, 1954; Shreve and Wiggins, 1964). Following are descriptions of these taxa and comparisons with related species. Since all three species were either dormant or at least not flowering at the time of collection, cuttings and/or seedlings were grown to maturity in the greenhouse. The descriptions that follow are therefore based primarily on these greenhouse plants.

1. *Jatropha giffordiana* Dehgan and Webster, sp. nov. sect. *Loureira* subsect. *Canescentes*; a *J. canescenti* et *J. cinerea* differt foliis glabriusculis exstipulatis, inflorescentia ♂ florem ♀ solitarium efferenti, petalis rubris, pistillo 3-loculato, stylis 2 stigmatibus multifidis (Figs. 1-7).

Shrub ca 1-1.5 m high; caudex thickened, stem and branches succulent, branches spreading and decumbent; bark fissured and peeling on older branches; short shoots numerous and distinct on older branches, 2-5 cm long, pubescent, with small leaves crowded near the apex. *Leaf*-with-petiole 3.5-8.5 cm long, 3-7 cm wide; stipules not evident; blade broadly ovate, unlobed, entire (completely devoid of glands), pubescent on the veins abaxially but otherwise glabrous, palmatinerved with five prominent and two weaker lateral veins, cordate at base, acute at apex. *Inflorescences* gynodioecious, terminal on branches or more often on short shoots, the plants pistillate and staminate; in the staminate racemose-paniculate, with many ♂ flowers and one central ♀ flower; pistillate inflorescence racemose, of 2-5 flowers; axis villose, ca 5-12 cm long in the male and 1.5-2.5 cm in the female; paracladia mostly 2-4 cm long in



FIGS. 1-7. *Jatropha giffordiana*. 1. Growth habit. 2. Pistillate flower, X2. 3. Detail of the pistillate flower, X3. 4. Staminate flower, X4. 5. Detail of the staminate flower, X4. 6. Staminate inflorescence with a 3-locular fruit from the single pistillate flower at the center, X1. 7. Cleared leaf, X1.

the male; lower bracts entire (not glandular), narrowly lanceolate, villose, ca 1–2 mm long in the male and 3–7 mm long in the female. *Staminate flower* urceolate, ca 8–10 mm long and 5–7 mm wide, with densely villose pedicel ca 3–4 mm long; calyx lobes 5, elliptic, somewhat pointed, entire (not glandular), ca 2–3 mm long and 1–1.5 mm wide, not imbricate; petals connate to more than $\frac{2}{3}$ their length, bright red, pubescent adaxially; disc segments 5, spherical, massive, ca 1 mm high and wide; stamens 10, monadelphous-biseriate, filaments connate to more than $\frac{2}{3}$ their length, ca 5–8 mm long, anthers elliptic, ca 1.3–1.5 mm long. *Pistillate flower* campanulate, ca 10–12 mm wide (somewhat wider in the staminate inflorescence), with densely villose, large and more or less foliaceous calyx lobes ca 15–20 mm long, 10–13 mm wide, not imbricate; petals connate to about the middle, bright red, villose adaxially; disc dissected, of (8) 10 glands, somewhat taller than broad, ca 0.7–1.0 mm wide and 0.8–1.1 mm high; ovary glabrous, of (2–) 3 carpels (always three in the terminal pistillate flower of an otherwise staminate inflorescence); styler column thick, connate to above the middle, dilated to 2 multifid stigmata. *Capsules* distinctly (2–) 3-lobed, ca 2–2.5 cm long and wide, somewhat dry, tardily dehiscent; seeds grayish-brown, more or less spherical, 1–1.5 cm long and wide, caruncle vestigial.

TYPE: Baja California, Cabo San Lucas, on dunes near the beach and facing the rocky hill, 17 Mar 1974, *Dehgan B74.019*. The population consisted of 20–25 plants. Type specimens from greenhouse-grown plants are deposited at DAV.

This species is named in honor of Professor Ernest M. Gifford for his contributions to the morphology of vascular plants in general and of shoot apices in particular.

Jatropha giffordiana is closely related to *J. canescens* and *J. cinerea* (*sensu lato*) as shown by several common characters in their vegetative morphology. McVaugh (1945b), with some justification, relegated *J. canescens* to synonymy under *J. cinerea* and in fact referred to it as a “race” of the latter. Taxonomic evidence presented elsewhere (Dehgan, 1976), however, shows the two species to be closely related but distinct. The intermediacy of certain populations (“races” *vide* McVaugh) in Baja California and western Mexico probably results from introgressive hybridization between the two taxa. *Jatropha canescens* (*sensu stricto*) is a disjunct relictual species otherwise occurring as isolated populations in northern parts of the Sonora Desert and in Magdalena Island (see Dehgan, 1976 for discussion). The extremely variable *Jatropha cinerea* (*sensu lato*), on the other hand, is widespread in western Mexico, particularly in coastal areas and from San Felipe southward in Baja California, but not on Magdalena Island.

Jatropha giffordiana differs from both *J. canescens* and *J. cinerea* in its decumbent growth habit, gynodioecious inflorescence, absence of stipules, bright red petals, and mainly 3-carpellate gynoecea with multifid

stigmata. In fact, the multifid stigma is unique for the entire genus. The occurrence of *J. giffordiana* as a small population apparently endemic to the tip of Baja California, a more tropical and moister region below the Tropic of Cancer, is also of some significance, since it may be an ancestral relict.

The following key describes extremes of *J. canescens-cinerea* complex and disregards intermediate individuals or populations as discussed by McVaugh (1945b). Further clarification of this species complex, including *J. giffordiana*, requires detailed biosystematic studies of various populations. No populations intermediate between *J. giffordiana* and the other two species have been observed. The descriptions of the two species as given by Pax (1910), particularly that of *J. canescens*, are quite inaccurate; and those of McVaugh (1945b) and Shreve and Wiggins (1964), for the reasons given above, are somewhat confusing. And finally, it should be emphasized that similarity of the vegetative characters, especially of the herbarium material, can be quite deceiving. The following somewhat deliberately detailed diagnostic key should, we hope, clear up the long-standing confusion with regard to the distinctiveness of the taxa under consideration.

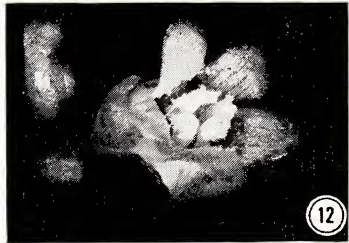
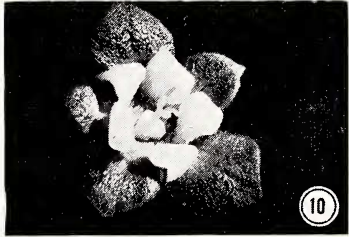
- a. Gynodioecious shrubs with decumbent branches and distinct short shoots; stipules absent; leaves sparsely pubescent on the veins, otherwise glabrous; staminate inflorescence racemose-paniculate with a single pistillate flower at the center; pistillate flowers campanulate, the staminate urceolate; ♀ calyx lobes 15–20 mm long, 10–13 mm wide; petals bright red; stylar column thick, dilated to 2 multifid stigmata *J. giffordiana*.
- a. Dioecious erect shrubs with or without distinct short shoots; stipules early deciduous or persistent; leaves pubescent on one or both surfaces; staminate inflorescence paniculate and lax or nearly sessile and compact without the central pistillate flower; flowers subglobose or tubular in one or both sexes; ♀ calyx lobes 8–12 mm long, 6–10 mm wide; petals greenish-yellow or pink-rose; stylar column narrow, dilated to 2 (rarely 3) bifid stigmata b.
- b. Nodes swollen and with very short arrested shoots; stipules linear-lanceolate and persistent; leaves orbicular, unlobed, entire and densely pubescent on both surfaces; male inflorescence subsessile, compact and many flowered; flowers of both sexes ± tubular; petals greenish-yellow *J. canescens*.
- b. Nodes not swollen and without arrested shoots; stipules lanceolate, early deciduous; leaves ovate-orbicular, often 3–5 lobed, with glandular margin when young, pubescent only on the adaxial surface; male inflorescence pedicellate, paniculate and lax; staminate flowers tubular but pistillate flowers subglobose; petals pink-rose *J. cinerea*.

Specimens of *Jatropha canescens* examined: SONORA: thorn scrub on lava, flat at base of slope, 15 mi SE of Guaymas, 21 Jun 1972, *Webster & Lynch 17002* (DAV). SINALOA: cactus thorn scrub on silty soil, plains ca 8 mi NW of Guamuchil, alt 20 ft, *Webster & Lynch 17038* (DAV). BAJA CAL. SUR: Magdalena Island, cactus thorn scrub on silty soil, foothills, alt ca 100 ft, 20 Mar 1974, *Dehgan & Webster 874.038* (DAV).

2. *Jatropha moranii* Dehgan and Webster, sp. nov. sect. *Platyphyllae*; a *J. purpurea* differt foliis exstipulatis 5-lobatis, bracteis eglandulosis, sepalis integris foliaceis, petalis chloroleucis recurvatis (Figs. 8–13).

Small shrub less than 1 m high with succulent stem and branches and a distinct woody caudex; bark fissured but not peeling, brown with white epidermal markings; short shoots not evident. *Leaf*-with-petiole ca 2.5–5.5 cm long and 1.5–3 cm wide; stipules not evident; blades ovate, distinctly 5-lobed, the margin ciliate with knob-shaped stipitate glands 2–4 mm long, papillose abaxially but papillose and hirsute adaxially particularly near the margins; palmately netted with 5 prominent veins, cordate at the base, cuspidate at the apex. *Inflorescence* monoecious, subterminal (occasionally appearing terminal or lateral); dichasia compound, paracladia of 1–2 dichasia each terminating in a pistillate flower; cofilorescence present and often distinct; inflorescence axis downy, ca 2–4.5 cm long, axes of paracladia ca 1–1.5 cm long; lower bracts entire (rarely with 1 or 2 glands), hirsute, lanceolate, ca 3–7 mm long. *Staminate flowers* subglobose, ca 8–12 mm long and 6–9 mm wide, with downy short pedicel 4–6 mm long; calyx lobes 5, elliptic, pointed, entire (not glandular), downy, ca 5–9 mm long and 2–5 mm wide, imbricate at base; petals recurved, connate to about $\frac{1}{2}$ their length, white, glabrous on both surfaces; disc segments 5, spherical, massive, ca 1–1.5 mm high and wide; stamens 10, monadelphous-biseriate, connate for most of their length; filaments ca 5–8 mm long; anthers elliptic, 1–1.3 mm long. *Pistillate flowers* campanulate, ca 10–14 mm long and 12–18 mm wide, with downy pedicel 8–11 mm long; calyx lobes 5, broadly elliptic, pointed, entire (not glandular), papillose on both surfaces, large and more or less foliaceous, ca 10–25 mm long and 10–15 mm wide, not imbricate; petals recurved, connate below the middle, white, glabrous on both surfaces; disc segments 5, broader than tall, ca 1.5–2.5 mm wide and 0.8–1 mm high; stylar column thick, connate to above the middle, dilated into 3 bifid stigmata. *Capsules* trilocular and distinctly trilobed, ca 1.5–2 mm long and wide, somewhat dry, tardily dehiscent; seeds grayish brown, more or less spherical, ca 1–1.5 cm long and slightly less wide, the caruncle lacerate.

TYPE: Baja California Sur, Cabo San Lucas, 6 Aug 1932, *John Thomas Howell 10606* (CAS, holotype).



FIGS. 8-13. *Jatropha moranii*. 8. Growth habit (greenhouse grown plant). 9. Inflorescence and leaves, ca. X1. 10. Pistillate flower, X3. 11. Detail of pistillate flower, X6. 12. Staminate flower, X5. 13. Detail of staminate flower, X5.

Additional collection: Cabo San Lucas, above the air strip, alt. ca 10 m, on alluvial rocky areas, Jul 1968, *John E. Bleck & Charles Glass 680—Dehgan B74.052* from greenhouse grown plants (DAV).

This species is named after Dr. Reid Moran of the San Diego Natural History Museum for his contributions toward the understanding of the flora of Baja California.

Jatropha moranii resembles *J. purpurea* in growth habit and in structure of the inflorescence. However, several characters suggest that the

two may not even be closely related. *Jatropha moranii* is quite distinct in its lack of stipitate glands on bracts and calyx lobes and its lack of stipules and its recurved white petals. Since we have seen no specimens of *J. purpurea* in Baja California and no herbarium specimens from Baja California, we suggest that references to *J. purpurea* in Baja California (e.g., by Standley, 1923; Shreve and Wiggins, 1964) may be based on *J. moranii*. These two species can be distinguished by the following synoptic key:

Stipules dissected into gland-tipped segments; petiole slender, 20–40 mm long; leaf blade 3–4 cm wide, shallowly 3-lobed, the median lobe narrowly triangular and much longer than the lower lobes, upper margins of lobes dentate but less conspicuously glandular than the basal margin. Bracts glandular-ciliate; sepals glandular-ciliate, linear-lanceolate in the pistillate flower; petals red, not recurved *J. purpurea*.

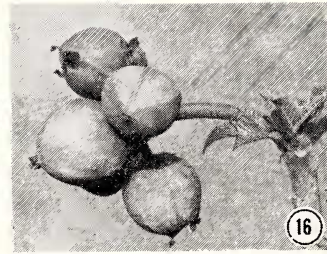
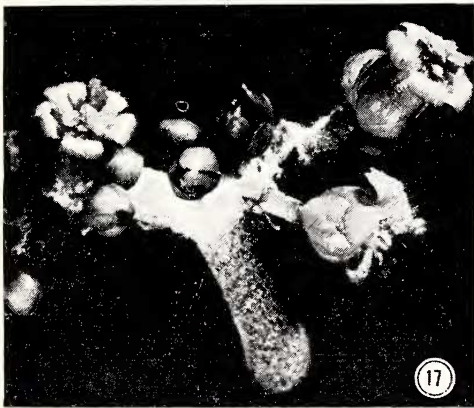
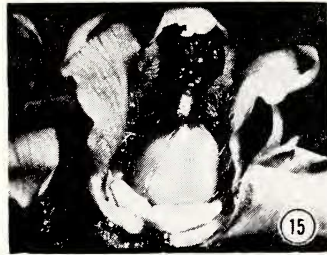
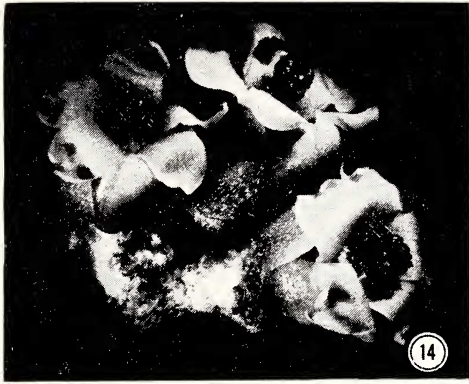
Stipules absent; petiole stout, 5–18 mm long; leaf blade 1.5–3 cm wide, shallowly 5-lobed, the median lobe widely triangular and nearly like the other lobes, margins evenly glandular throughout. Bracts mostly without glands; sepals entire (not glandular), broadly elliptic and more or less foliaceous in the pistillate flower; petals greenish-white, recurved . . . *J. moranii*.

Specimen of *J. purpurea* examined: SINALOA: Cerro Llano Redondo, west of Caymanero, 8 Oct 1944, *Howard Scott Gentry 7088* (DS).

3. ***Jatropha mcvaughii*** Dehgan and Webster, sp. nov. sect. *Curcas*; a *J. curcas* differt ramis cortice fissurato, foliis pubescentibus, inflorescentiis dioeciis, petalis in dimidio inferiore connatis, stylis crassis, seminibus 10–12 mm longis non incrustatis (Figs. 14–18).

Syn. *Jatropha curcas* var. *rufus* McVaugh, Bull. Torrey Bot Club 72: 284. 1945.

Shrub or small tree, 1.5–3.5 m high; branches and foliage pubescent; bark fissured or cracked, but not peeling. *Leaf*-with-petiole 25–35 cm long when mature; stipules narrowly lanceolate, early deciduous; blades ovate, 5–7 (9) lobed with the upper lobes extending to near the midrib and lower lobes shallow, mostly 15–25 cm long and nearly as wide, palmatinerved, with 7(9) primary nerves, broadly cordate at the base, cuspidate at the apex, pubescent on both surfaces; margins entire (completely devoid of glands). *Inflorescence* dioecious, terminal on branches, with typical jatrophoid compound dischasia in both sexes but with much smaller number of flowers in the pistillate inflorescence; axis tomentose, ca 7–12 cm long in the staminate and 3–6 cm in the pistillate; paracladia terminating in a single flower; those of the pistillate inflorescence ca 1–2.5 cm long, but those of the staminate inflorescence 1–1.5 cm long; lower bracts entire, lanceolate, pubescent, 4–9 mm long in the male,



FIGS. 14-18. *Jatropha mcvaughii*. 14. Pistillate inflorescence, X3. 15. Detail of pistillate flower, X4. 16. Fruit, ca X1. 17. Staminate inflorescence, X4. 18. Detail of staminate flower, X8.

somewhat longer in the female. *Staminate flowers* \pm tubular with corolla tube longer than the lobes, 8-12 mm long and 5-8 mm wide; pedicel tomentose, ca 4-8 mm long; calyx lobes 5, elliptic, pointed, entire (not glandular), smaller than in the female, ca 4-7 mm long and 2-3 mm wide, imbricate; petals obovate, connate to about $\frac{1}{2}$ or more of their length, greenish-yellow, hirsute adaxially, villose abaxially; disc segments 5, massive, ellipsoid, ca 2-3.5 mm long and 1-1.5 mm wide; stamens 10, monadelphous, scarcely biseriate, the filaments connate to about $\frac{1}{2}$ their length, ca 3-5 mm long; anthers oblong elliptic, somewhat flattened at the apex, ca 1.5-2 mm long. *Pistillate flowers* ca 5-11 mm long, with tomentose pedicel, \pm campanulate, corolla tube shorter than or nearly equalling lobes, ca 8-11 mm long and 10-14 mm wide; calyx lobes 5, elliptic, pointed, entire (not glandular), ca 7-10 mm long and 3.5-5 mm wide, imbricate; petals obovate, connate to about $\frac{1}{3}$ their length, greenish-yellow, hirsute adaxially, villose abaxially; disc segments

5, massive, broader than long, ca 1–1.3 mm long and 2.5–4 mm wide; ovary glabrous, of 3 carpels; stylar column thickened, connate to about middle, not dilated but with 3 bifurcate, massive, dark green stigmata. *Capsules* ellipsoidal, ca 2 cm long and 1.5 cm broad, \pm fleshy, at length drying and tardily dehiscent; seeds light brown, 10–12 mm long and 8–10 mm wide, the caruncle appressed to the beak and nearly vestigial, ca 1 mm or less long and 1.5–2 mm wide.

TYPE: Mexico, Jalisco, Playa Scandida, Dec 1974, *Dehgan B74206* (DAV). The species has been observed from Mazatlán to an elevation of ca 350 m on the road to Durango.

Additional specimens examined: SINALOA: Ymala, Aug 1891, *Palmer 1413* (US, holotype); Mazatlán, *Ortega 7299* (CAS); Culiacán and vicinity, *Howard Gentry 7046* (CAS). NAYARIT: thorn woodland 11–12 mi NE of Singayta, alt ca 200 ft, 25 Jun 1972, *Webster & Lynch 17070* (♀), *17073* (♂) (DAV).

This species is named in honor of Professor Rogers McVaugh, in recognition of his contributions toward understanding of the genus *Jatropha* in particular (1944, 1945a, 1945b) and to the systematics of neotropical flowering plants in general.

Jatropha mcvaughii was earlier described as *J. curcas* var. *rufus* by McVaugh (1945b). Although originally distinguished by McVaugh solely on the basis of pubescence, it actually differs from *J. curcas* in a number of characters: fissured bark, dioecious inflorescences, longer corolla tube, thick stylar column with undilated stigmata, and smaller smoother seeds. Although the color and quantity of pubescence does furnish a convenient recognition feature for *J. mcvaughii*, the dioecious flower production seems systematically more important. We thus conclude that while *J. mcvaughii* clearly belongs to sect. *Curcas* and is closely related to *J. curcas*, it differs sufficiently from the latter to be considered a distinct species, as is evident in the following synoptic key:

- Bark smooth, branches and mature foliage glabrous; leaf blades unlobed or with (3)5–7 very shallow lobes; monoecious, bisexual or often unisexual; petals greenish or yellowish-white, connate at the base; styles slender, dilated into massive stigmata; capsule ca 3 cm long and 1.5 cm broad; seeds 15–32 mm long, blackish-encrustate-striate *J. curcas*.
 Bark fissured or cracked, branches and mature foliage pubescent; leaf blade with 5–7(–9) deeper lobes; dioecious; petals greenish-yellow, connate to about half their length; styles thick, undilated, with fleshy stigmata; capsule ca 2 cm long and 1 cm broad; seeds 10–12 mm long, light brown and without striations *J. mcvaughii*.

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CHEMOTAXONOMIC STUDIES
IN THE SAXIFRAGACEAE S.L.
9. FLAVONOIDS OF JEPSONIA

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Jepsonia is a small genus of the Saxifragaceae restricted to California and northern Baja California. Ornduff (1961) described the distylous nature of the flowers and, more recently, presented a detailed account of the ecology, morphology and systematics of the genus (Ornduff, 1969). No chemical study of the genus appears to have been done. An investigation of the polyphenolic constituents of *Jepsonia* was thus undertaken as part of a general chemotaxonomic survey of the family. It was hoped that flavonoid data might yield additional characters useful for characterizing the species and offer insights into the enigmatic relationships between *Jepsonia* and other genera in the family.

MATERIAL AND METHODS

The plant collections used in this study are: *J. heterandra* Eastw., Bagby, Mariposa Co., Cal., 20 Mar 1970, G. D. Cromwell 101, RSA; *J. malvifolia* (Greene) Small, Santa Catalina Island, Los Angeles Co., Cal., 8 Mar 1970, R. F. Thorne 39392, RSA; *J. parryi* (Torr.) Small,